

# “ AI and Other Technology ”

## Vol. 3 Traffic Control

AI technology is essential technology for automated operations used in the field of traffic control. For example, AI technology is used to predict traffic conditions and avoid collision with pedestrians or other automobiles by means of input from sensors on automobiles and image processing technology.

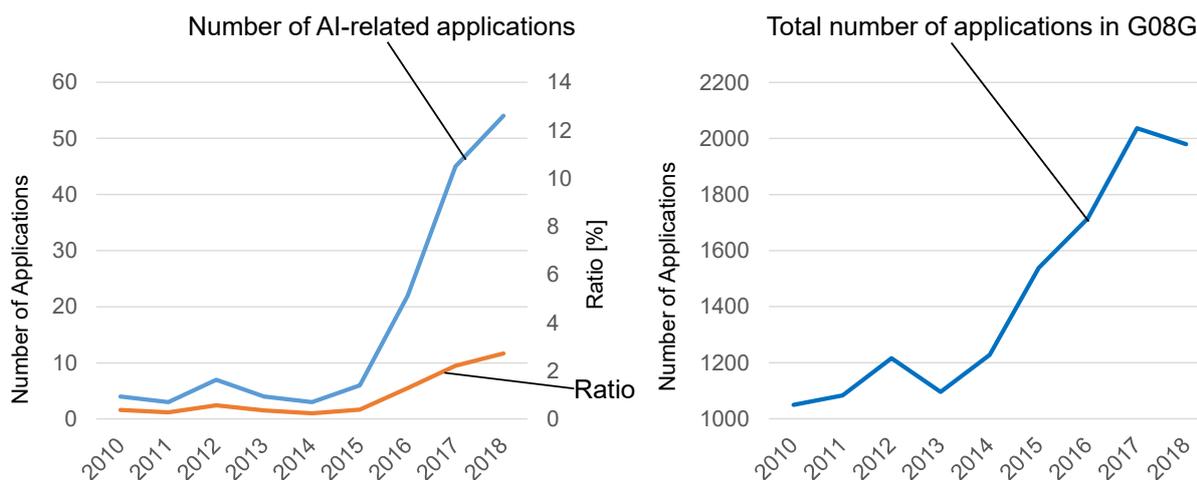
This article focuses on AI-related patents in the field of control and regulation and shows analyses and examples with reference to the following report by the JPO.

[https://www.jpo.go.jp/system/patent/gaiyo/sesaku/ai/ai\\_shutsugan\\_chosa.html](https://www.jpo.go.jp/system/patent/gaiyo/sesaku/ai/ai_shutsugan_chosa.html)

(“Research on applications of AI-related inventions” –Japanese only)

1) The number of patent applications of AI-related inventions in the field of "Traffic controls"

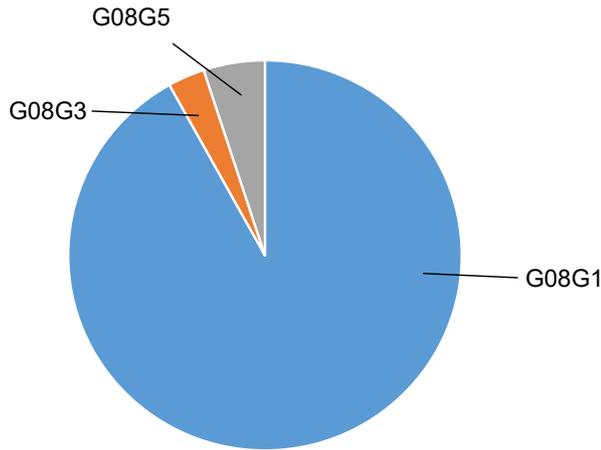
The number of patent applications of AI-related inventions in the field of "Traffic controls" and the ratio of AI-related inventions in patent applications in the field of "Traffic controls" are as shown below.



As shown in the above graph, both the number and ratio of AI-related inventions in the field of traffic controls have grown since 2014.

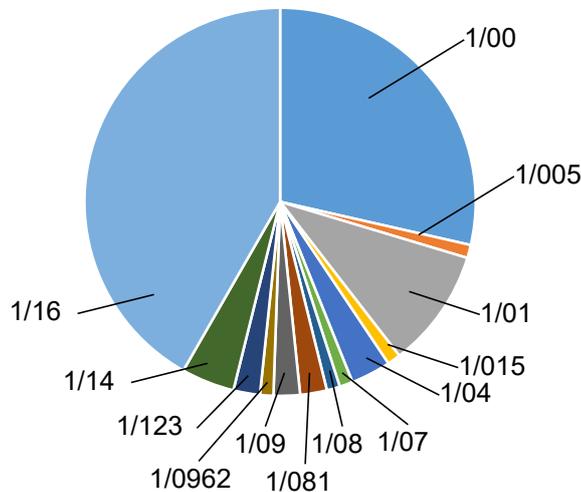
2) Breakdown of Inventions by IPCs

The breakdown of inventions filed between 2016 and 2018 by their main IPCs is shown as below.



- G08G 1: Traffic Control systems for road vehicles
- G08G 3: Traffic Control systems for marine craft
- G08G 5: Traffic Control systems for aircraft

It is clear from the above graph that the number of patent applications related to Traffic Control Systems for Road vehicles is large. This is assumed to be a result of the recent developments in automatic operation technology for automobiles. Although small in number, AI technology applications to both marine aircraft and vessels have just begun. The breakdown of patent applications related to "Traffic Control Systems for Road vehicles" is shown below.



- G08G 1/00: Traffic Control Systems for Road vehicles
- G08G 1/01: Detecting Traffic Movement
- G08G 1/16: Anti-collision Systems

As can be seen from the above graph, the number of patent applications related to General Traffic Control Systems for Road vehicles (G08G 1/00) and Anti-collision Systems (G08G 1/16) is large. Collision prevention of an automobile with pedestrians or other automobiles have been considered necessary for the developments in automatic operation technology.

### Characteristics of Claims

As mentioned above, the claims of AI-related patents in the field of traffic control mainly include the following three inventions:

#### 1. Traffic Control Systems for Road vehicles

AI technology is used for properly determining various traffic conditions so as to present information according to the traffic conditions and control traffic signals according to the traffic conditions.

#### 2. Detecting Traffic Movement

AI technology is used for determining the operational status of vehicles, such as the driver's status or the conditions of the car's components based on data detected by sensors on the vehicles. Because there are various operating conditions of vehicles, it is possible to accurately determine the various operational conditions of a vehicle through AI technology.

#### 3. Anti-collision Systems

Development of the technologies for avoiding collision with pedestrians and other vehicles is necessary for autonomous vehicle development. Because there are various movement patterns for pedestrians and vehicles, AI technology is useful for determining the risk of collision with pedestrians and other vehicles based on their movements.

### Claim Examples

#### 1. Traffic Control Systems for Road Vehicles (G08G 1/00)

Example: Patent No.: 6666202

[Claim 1]

*An accident forecasting system comprising:*

*an accident forecast table creation processing unit which learns accident occurrence patterns based on a predetermined learning algorithm using past traffic data and past accident data for each of multiple routes where a traffic accident has occurred, and creates an accident forecast table representing a certain accident occurrence degree which shows probability of accident occurrence for each traffic situation;*

*an assignment table creation processing unit which, for a route where a traffic accident has occurred, assigns an accident forecast table created based on the data of the route, and for a route where no traffic accident has occurred, assigns the accident forecast table assigned to a route similar to one of the routes where a traffic accident has occurred, so as to create an assignment table;*

*a data acquisition processing unit which acquires current traffic data from a sensor measuring traffic conditions for a route to be forecast; and*

*an accident forecast processing unit which, for the forecast target route, forecasts the accident occurrence degree using the corresponding accident forecast table identified with reference to the allocation table, and the current traffic data.*

[Brief Summary]

The above claim relates to a system for forecasting accident occurrence degree on a road where no traffic accident has occurred such as newly constructed road. For road (A) where a traffic accident has occurred, the system learns the accident occurrence patterns using past traffic data and past accident data regarding the road (A), and forecasts the accident occurrence degree based on the current traffic data of the road (A) and the learned contents regarding the road (A), and for road (B) where no traffic accident has occurred, the system forecasts the accident occurrence degree based on the current traffic data of the road (B) and the learned contents regarding one of the roads (A) similar

to the road (B).

## 2. Detecting Traffic Movement (G08G 1/01)

Example: Patent No.: 6640769

[Claim 1]

*An information processing apparatus comprising:*

*an accumulation processing unit for accumulating probe information received from a vehicle in accordance with predetermined collecting conditions;*

*a model generating unit for generating a model for determining whether an event corresponding to a condition for delivering service information related to a service to the vehicle based on the accumulated probe information;*

*a model evaluating unit for determining whether the event included in the service information delivered in accordance with generated model is generated with a predetermined accuracy; and*

*a deleting unit for deleting the unused probe information, which is not used in other services, of the accumulated probe information, when determining that the event was not generated with the predetermined accuracy.*

[Brief Summary]

In the above claim, the apparatus determines the necessity of each accumulated sensor information based on the machine learned model to change the data collecting condition of the vehicle so as to reduce the amount of data sent from a plurality of vehicles to an information center as well as data maintenance costs at the center.

## 3. Anti-collision Systems (G08G 1/16)

Example: Patent No.: 6626549

[Claim 1]

*A determining apparatus comprising:*

*a determining unit for determining whether a subject work vehicle is in a situation where there is relatively high possibility of an accident occurring based on surrounding noise around the subject work vehicle, by using a learned model generated by machine learning using training data generated from sounds which are collected in a facility where a plurality of work vehicles run, and which are specific to situations just before the occurrence of an accident or situations in which an accident is likely to occur, wherein*

*the peculiar sound comprises back alarm sound generated by the backing work vehicle and back alarm sound generated by other work vehicles backing around the work vehicle.*

[Brief Summary]

In the claim above, the apparatus learns the sounds regularly made in situations where there is a high possibility of accidents occurring (including back-up beeper sounds made by work vehicles when reversing) associated with the said situations and deduces the said situation based on detected sounds. This allows the apparatus to determine the signs of the occurrence of accident based on sounds and not captured images or output values from object-detecting sensors.

### Conclusion

As per the claim examples, technologies combined with AI have been drawing more attention in the field of traffic control. AI technologies make detecting and determining conditions of vehicles, conditions of traffic, and conditions of pedestrians and other surrounding vehicles easy and effective. Thus, development of AI technologies is necessary for the development of automated operations.

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Mr. Kuroda specializes in industrial machinery. He has conducted research on semiconductor devices for optical communication, such as semiconductor lasers. Mr. Kuroda regularly visits overseas clients mainly in Europe and the U.S. to provide them with updated information on IP matters in Japan. He has experience in the research and development of optical transmitters and receivers for long-distance optical communication and signal waveforms with a low error rate.